Creat'AI: Using Tangible Storytelling to Teach AI to Children

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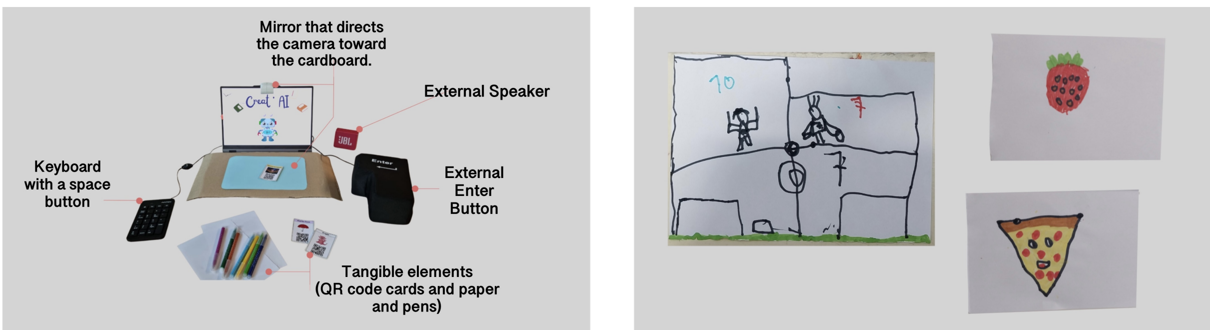

Figure 1: Left: *Creat'AI*, a tangible storytelling prototype designed to teach AI concepts to young children. It includes a keyboard, mirror, external speaker, external enter button, and tangible elements such as QR code cards, paper, and pens. Right: Drawings created by children to interact with the AI and contribute to the storytelling process, depicting a soccer game, a strawberry, and a slice of pizza.

Abstract

The widespread presence of Artificial Intelligence (AI) and the growing use of AI agents raise concerns about potential biases, privacy risks, and exposure to inappropriate content, underscoring the need to educate children about AI. To address this issue, we organized a collaborative workshop with four experts to brainstorm activities to teach AI to children. As a result, we developed *Creat'AI* — a GenAI-powered tangible prototype that co-creates original stories with children. We evaluated *Creat'AI* in a school with 17 children from the 1st grade. Our preliminary findings show that children were engaged in the activities and understood AI's capability to generate original content, and changed their previous perception of AI and recognized that AI-generated content can be inaccurate. These results highlight the prototype's potential in promoting AI literacy, contributing to the responsible and informed use of AI by young children.

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Keywords

Artificial Intelligence, Generative Artificial Intelligence, Storytelling, Playful Learning, Tangibles, Embodiment

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1 Introduction

AI has become pervasive, and the well-known ChatGPT 4.0 has highlighted both the benefits and harms of AI, opening access to anyone with the internet. Today, children have access to tablets and toys with computing power that surpasses that of the past. Previous research has shown that children may need a clearer understanding of how smart toys and other intelligent agents work, unintentionally disclosing personal information or becoming overly reliant on these devices [23, 25]. It has posed numerous ethical questions and raised concerns about potential bias in training datasets, exposure to inappropriate content, and privacy concerns [26]. As a result, AI literacy, a 21st-century skill, is becoming increasingly essential for children in light of the growing presence of intelligent machines [4] emphasizing the need to introduce children to AI concepts in their early stages [10]. .Additionally, AI education can also bring positive outcomes besides fostering AI knowledge, such as the development of soft skills like creativity, emotional control, collaborative work, and critical thinking [20].

One promising approach is to use interactive objects as young children learn better if they perform hands-on experiences, manipulate objects, and observe the effects [5, 14–16, 19]. Several research studies have shown that incorporating interactive objects or tangibles can greatly aid young children in comprehending abstract concepts. These tools allow children to transform abstract ideas into actions, providing a hands-on approach to learning [5, 14–16, 18, 19]. Combining tangible objects with technology offers a range of benefits such as multi-sensory learning, active engagement, adaptability, collaboration, immediate feedback, and the development of essential 21st-century skills.

In this research, we focus on GenAI, a recent and rapidly evolving technology with limited research in the context of young children [27]. We organized a collaborative brainstorming workshop with experts in technology and child education to inform the design and development of *Creat'AI* - a tangible AI system specifically designed to support children to explore and understand fundamental concepts of Generative AI (GenAI). To achieve this, we adopted a playful approach, to increase creativity, peer collaboration, and spontaneous learning, and to make complex concepts more approachable for young learners [17]. We then conducted a pilot test with two children to refine the activities and prototype and finally, we evaluated how 17 children engaged with *Creat'AI* and gained an understanding of AI functionality and limitations. Our preliminary results indicate that *Creat'AI* was an effective and innovative approach to introduce young learners to the principles of GenAI.

2 Related Work

We discuss related work across three key research areas focusing on children: studies on recent advances in AI curricula, followed by research on generative AI, and finally, we explore the role of storytelling and tangibles.

In the last decade, research has been concerned with creating **AI curricula** for children [11, 24, 28] from kindergarden to high school aimed at promoting AI understanding in children, which include the importance of sensors, agents internal model and representations, the importance of data to ML, the challenge of human-ML interaction, and AI's social impact and risks. One different approach to teach AI is Popbots [27] an interactive AI tool, designed to teach three fundamental AI concepts (knowledge-based systems, supervised and GenAI). Their results highlighted the importance of encouraging exploration and active participation, uncover black-boxed concepts for better comprehension, and deliver sensory feedback.

On the other hand, research on **GenAI** started to explore how ChatGPT can be used as a virtual tutor and educational tool to promote AI literacy, provide personalised learning experiences, and foster engagement with AI [21]. While these tools have great potential to create varied and engaging teaching materials, Cooper [8] emphasised the need for teachers to use the tool responsibly, and adapt it to their students' specific needs, emphasising the need for further research and clear guidelines to promote responsible and ethical appropriate use of GenAI.

Recent developments in GenAI also offer new possibilities for **storytelling** systems that can enhance creativity and learning for young children [9], language proficiency, social understanding, and emotional growth [9]. For instance, Chin et al [7] used ChatGPT to leverage the creation of storytelling in family settings. Han et al study [9] enabled children to build stories using visual elements like characters, props, and settings whereas with StoryDrawer [29] children could draw and narrate their stories. With these digital technologies, children interact with digital inputs to create various types of prompts for the AI.

The storytelling experience can be enhanced by leveraging **embodiment and tangible**/interactive objects [18, 22]. Through the interaction with physical objects, children can engage in more meaningful story creations since the tangible tools can represent different parts of their stories[18]. Kuang et al.[13] used tangible objects to introduce an AI-powered physical board game, Memeopoly, that integrates tangible play with ChatGPT customisation potentials. Through AI, players contribute to the gaming experience by inputting game rules, character characteristics, and the overarching narrative. Existing approaches to teach GenAI to rely on digital technology [1, 6, 11, 12], missing the opportunity to leverage the benefits of embodied learning and tangible interaction for young learners.

3 *Creat'AI*: A Tangible Storytelling to Teach AI to Children

Creat'AI was developed through an iterative design process which began with an ideation workshop, followed by design and development, pilot testing, refinement of activities and prototype, and concluding with a final evaluation.

Ideation Workshop. To design an age-appropriate activity to enhance children's understanding of AI, we organized a workshop with four experts in technology and education (two female, aged 28 and 40, and two male, aged 27 and 45) to brainstorm and discuss potential concepts tailored for first-year students in a school setting. The workshop was structured as follows: a brainstorming exercise, first they individually listed and categorized activities and games commonly enjoyed by children without technology, and then collaboratively brainstorm on how to include AI in those activities. Then individually, participants detailed the game mechanics in a structured template outlining game's rewards, rules, environment, story, characters, goals, and the evolution of the game, inputs and outputs. They also designed a flowchart detailing how children would interact with both the materials and the AI prototype during the activity. And finally, they shared their created activities with the group.

From the results we derived some design considerations to take into account for the development of our AI prototype, such as: include tangible objects as input (to enable hands-on experiences);

storytelling to introduce AI to children (to enhance children's engagement and learning); immediate feedback (so children can learn through observing their choices reflected in the evolving narrative), personalization and customisation (to motivate and engage children) .

3.1 Design of *Creat'AI*

. We designed *Creat'AI* to engage children in creating original stories through playful interactions with a GenAI, while simultaneously fostering an understanding of AI's capabilities and limitations. The *Creat'AI* prototype consists of several components, including a computer, a mirror, a large enter button, an external space button, QR Code cards, a cardboard platform, and an audio output device (see Figure **??**). We used gpt-3.5-turbo, gpt-4.0 and DALL-E-3 and Whisper for the different requests and data type.

Creat'AI leverages an storytelling activity for children to collaboratively create imaginative stories with their peers and the AI agent. The system is designed to encourage chidlren to interact through various input types, such as using their voice, tangible cards or by drawing with paper and pencil. Our aim was to introduce children to AI concepts in a playful way: (1) GenAI has the potential to create original content given different inputs; (2) AI has the potential to interpret different types of input, from image, voice, or text; and (3) GenAI can generate false or inaccurate content.

Pilot Study. To obtain preliminary insights into how children would interact with the agent, and to assess whether any adjustments were needed in the prototype or activity we conducted a pilot study with two first-grade female children aged 7. The activity started with children collaboratively selecting the story's environment and main character and then the AI agent began narrating the story. In each iteration, it posed a question to the children, processed their responses, and generated a new story fragment, progressively building the narrative. The session lasted approximately 45 minutes, as the children remained engaged and repeated the storytelling process four times to co-create a story.

From this pilot, we decided to modify the prototype to: have lengthy stories (as we observed children expecting more extended narratives); enable each child to have their own character personalized by them (as each child wanted to have their own character); emit a sound whenever a card is successfully detected (they did not knew when to stop showing the cards to the camera); add an explanatory activity of how AI works (children had a limited understanding of how the GenAI agent processed and created information).

3.2 Evaluation Study

Our goal was to assess whether interacting with *Creat'AI* in an engaging, embodied, and playful manner could support in understanding GenAI functionality and limitations.

Participants. Seventeen children (7 females, 10 males) from a first-grade class, ages between 6 and 7 years old assented to participate in our study. The study was conducted at a public school located in a low-socioeconomic neighborhood in Lisbon (Portugal).

Procedure. The study consisted of two sessions on two different days, with the same children and the same three researchers present. The researchers were responsible for guaranteeing the flow of the activity and supporting children through each step if needed. To assess if children improved their understanding of AI after interacting with *Creat'AI* we conducted a ***pre and post-tests*** to each child individually, consisting of a predefined questionnaire based on Andries et al. [3] and Hitron et al. [10]. Questions addressed children's awareness and understanding of GenAI, including their perceptions of AI's thinking, decision-making, and creativity; AI's ability to collaborate, and recognize inputs like drawings and voice, whether AI possesses emotions or social attributes, and AI ethical considerations A. In the post-test we added questions to include children's experiences with *Creat'AI*.

Session 1 started with and individual pre-assessment questionnaire. Then in groups of 2-3, children interacted with *Create'AI* that leveraged an interactive tutorial to introduce the potential of GenAI and explain how AI can process, interpret and and generate content based on children's inputs (voice, drawing or QR code cards). This tutorial emulates the behaviors of the storytelling activity, describing how it processes children's inputs. In **Session 2**, children interacted with *Creat'AI* to co-create a story. The AI agent starts by requesting children to choose the context where the story will take place, to which they could answer together with one or multiple QR Code cards. Next, each child was encouraged to use the QR Code cards to present the characteristics of their main character, either by specifying animals, fantasy characters, objects or emotions. Each story had two or three main characters depending on the number of children playing the activity. After choosing the context and main characters, the agent generates the first story fragment in audio and ends with a question to the children. Then, the activity enters a loop for each input type, where children explored and collaborated to respond to the agent's question using the diverse input types. During the activity, children were encouraged to think, cooperate, and co-create their story together when deciding the story's context as well as when answering the agent's questions. In each step of giving their input to the GenAI agent' children could either use the QR Code cards, drawings or their voice, collaboratively or individually. The objective of this activity was to let children freely explore the three different kinds of inputs in a story co-creation context and to understand how their inputs impact the flow and content of the story being generated by the agent.

Data Collection and Analysis. The two sessions were video and audio recorded. Two researchers were responsible for analyzing the transcriptions and video recordings, while a third researcher was responsible for reviewing and validating the results. We followed a thematic analysis and it involved systematically examining the recordings to find recurring body behaviours, facial expressions and children's interactions with the prototype and with their peers. We also analysed the pre and post-assessments to assess how the GenAI storytelling activity impacted children's understanding of AI.

Preliminary Results. During both sessions, children interacted with an environment composed of a tangible device, QR code cards, drawings and buttons. Children demonstrated ***engagement*** - observed with smiles and open posture - throughout the sessions and excitement to continue and hear the next story piece in Session 2. Moreover, the illustrations generated by the AI during the storytelling activity was the most exciting aspect for the children (C6: *"It is very beautiful!"* and C2: *"He draw my crown!"*).

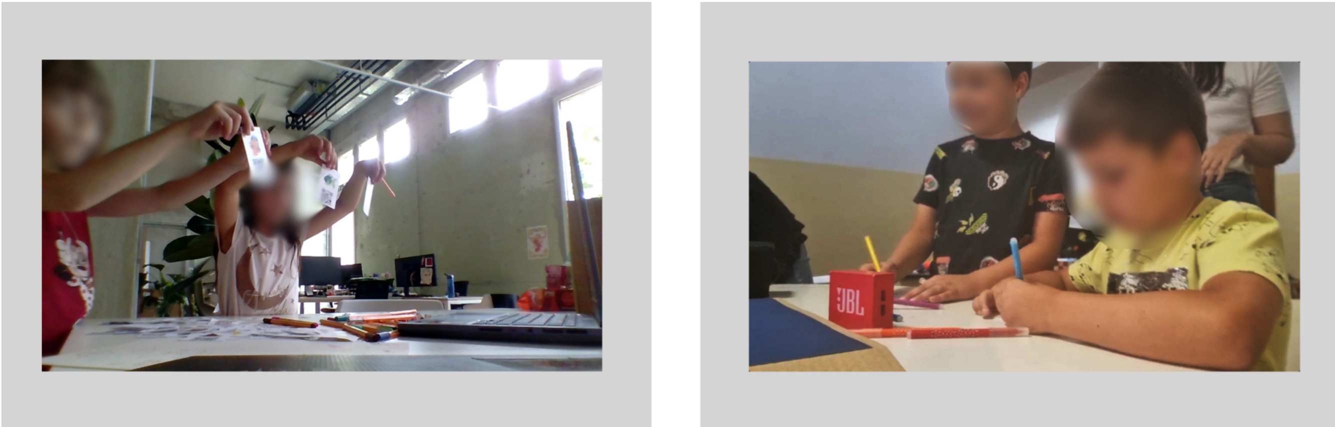

Figure 2: Children interacting with Creat'AI during the pilot study (left), displaying their selected QR code cards, and during the evaluation study (right), drawing to use as input.

Already before the sessions, the majority of children (12 out of 17) already thought that AI was able to understand their inputs, either by text, image or voice. But, after the activities with *Creat'AI* ***all 17 children understood that AI can recognise their inputs***, showing that the agent might have successfully fostered that knowledge.

Children rated QR code cards as their ***favorite input***. Although voice input can be considered the easiest input method, many children were shy when asked to use their voices, which affected the overall experience. This hesitation sometimes caused them to speak softly, sometimes leading the agent to misinterpret their response.

Children smiled and laughed when they saw that the agent ***processed their inputs correctly***.On the contrary, when the agent's generated content did not match children's expectations, the dominant reactions were disappointment and confusion, eg.: C10 exclaimed, *"It has nothing to do with it!"*. But these unexpected errors also generated laughs as children understood that the LLM failed.

When we asked children *"Does AI always give correct answers?"* initially the majority of children (12 out of 17) answered that AI always generates reliable answers. After interacting with Creat'AI, 7 children changed their answer from *yes* to *no*. So after the evaluation Study, only 6 out of 17 children believed that AI always gives reliable answers. This indicates that children could understand that ***AI can also provide false information***. These two findings provide crucial information that children are aware of GenAI hazards, given that it does not always generate correct content.

4 Discussion

We contribute with *Creat'AI*, a tangible, interactive tool that leverages storytelling and embodied learning to introduce GenAI to elementary school children. Through co-creating a tangible storytelling with *Creat'AI*, children grasped AI's generative capabilities but also recognized its limitations, particularly its potential for inaccuracies. Existing work on AI literacy has often relied on screen-based applications, structured curricula, or teacher-led instruction [2, 11]. However, research suggests that embodied and tangible learning approaches — where children engage physically with abstract concepts — can enhance cognitive retention, creativity, and engagement [18, 22]. *Creat'AI* extends this embodied learning approach to the domain of AI education, enabling children to interact with an AI system through multiple input modalities, including QR code cards, drawings, and voice. With *Creat'AI* we introduced children to AI concepts, such as its capacity of generating human-like content, given different prompts and different input types, and its potential inaccuracy. The storytelling activity required children to explore the ability of GenAI to create stories and illustrations given their inputs. A key outcome of our study was the shift in children's perceptions of AI after interacting with *Creat'AI*. Initially, many children assumed that AI always provided correct answers, reflecting the common misconception that AI is infallible [26]. However, after two sessions with *Creat'AI*, a significant number of children revised their views, recognizing that AI can generate incorrect or incomplete content. This finding is crucial, as it demonstrates that *Creat'AI* can foster a more critical understanding of AI's strengths and limitations, a key aspect of AI literacy. Given the rapid evolution of AI technologies, ensuring that children develop a well-rounded, critical perspective on AI from an early age is more important than ever.

5 Limitations and Further Work

This study was conducted in a single elementary school class in Lisbon (Portugal), limiting the generalization of our findings. Future research should include a great number of children, a more diverse sample, including children from various cultural and educational contexts, as well as a broader age range, to gain a deeper understanding of developmental differences in AI literacy. Additionally, the study consisted of only two consecutive sessions, providing children with a brief introduction to the prototype. A longer study with multiple sessions would allow for more sustained engagement, reinforcing AI literacy concepts over time.

In this WiP, we present *Creat'AI*, a GenAI-powered storytelling tangible prototype designed to co-create stories with children. By combining storytelling, tangible interaction, and real-time AI feedback, this research contributes to the development of innovative educational tools that foster critical thinking, creativity, and responsible AI use among young learners. Future work will explore expanding this approach to additional educational settings, incorporating longer-term engagement, and refining AI's response mechanisms to further enhance learning outcomes.

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6 Selection and Participation of Children

This study was approved by the Ethics Committee of Instituto Super Técnico (Portugal) and the Data Protection Office from the University of Lisbon (Portugal) and was additionally authorized and supervised by the school directors and educators. We collaborated with a public school from a low socioeconomic background previously attended by the first author a decade ago. Parents and legal guardians received consent forms outlining the activities, data analysis procedures, and intended uses of the collected data. Once consent was obtained, we confirmed that all children were willing to participate, understood their right to withdraw at any time, and provided their assent. Throughout, we prioritized a positive and playful experience for the children.

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A AI Children's Assessment Questionnaires

Pre-Assessment:

(1) Have you heard of Generative Artificial Intelligence? Or ChatGPT? What do you think it is? Examples: Animal, Object, Human, Robot, Something else.
(2) Have you ever talked to a computer or another technology?
(3) Does AI think for itself? Yes, Maybe, No.
(4) Does AI think like… Us (humans), Robots, Animals, Something else?
(5) Does AI make decisions? Yes, Maybe, No.
(6) Is AI intelligent? Yes, Maybe, No.
(7) Do you think AI always provides correct information? Yes, Maybe, No.
(8) Does AI choose to do things? Yes, Maybe, No.
(9) Do you think Artificial Intelligence can create new things, like stories or drawings? And other things? How?
(10) Do you think a person would create better stories than AI?
(11) How do you think you will create a story together with the Avatar?
(12) Do you think Artificial Intelligence will be able to recognize your drawings? And your voice? How?
(13) Do you think AI can also draw? Yes, Maybe, No.
(14) Does AI have feelings? Yes, Maybe, No.
(15) Does AI have friends? Yes, Maybe, No.
(16) Do you think there are situations where Artificial Intelligence should not be used?

Post-Assessment:

(1) And now, what do you think Generative Artificial Intelligence is?
(2) Have you ever talked to a computer or another type of technology?
(3) Do you think there are situations where Generative Artificial Intelligence should not be used?
(4) Do you think Generative Artificial Intelligence is smarter than humans?
(5) Do you think Artificial Intelligence can create new things, like stories or drawings? What about other things? How?
(6) How was it to create a story together with the AI agent? What did you think of the stories and drawings created?
(7) Did the AI agent recognize your drawings? How?
(8) Do you enjoy using the computer to learn new things? Why?
(9) How did you feel about creating a story together with the avatar AI agent? Did you prefer using the cards, making drawings, or talking with the avatar AI agent?
(10) Is there any suggestion or modification you would like us to make? if we come in a few months what would you appreciate to do to learn more about AI?